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(54) Title: TECHNIQUES FOR PERFORMING UMTS (UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM) AUTHENTICATION USING SIP (SESSION INITIATION PROTOCOL) MESSAGES

(57) Abstract: A technique for authenticating a user to a server using SIP messages includes forwarding an SIP request from the user agent to the server. The server then forwards a request for authentication to the user agent in response to the invite request, the request for authentication including information that the authentication will be performed using a UMTS AKA mechanism. The user agent then forwards and authentication response to the server in accordance with the UMTS AKA mechanism and the server then performs the appropriate actions to perform an invoked SIP procedure in response to the SIP request. The SIP request may include any standardized SIP request including an SIP INVITE request or an SIP REGISTER request. The request for authentication may include one of an SIP 401 Unauthorized code or an SIP 407 Proxy Authentication Required code. The request for authentication should include UMTS AKA RAND and AUTN vectors, which may be included in an SIP WWW-Authenticate or Proxy-Authenticate response header field. The authentication response should include one of either a UMTS AKA RES code or an AUTS code or an error code.

TECHNIQUES FOR PERFORMING UMTS (UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM) AUTHENTICATION USING SIP (SESSION INITIATION PROTOCOL) MESSAGES

TECHNICAL FIELD

The present invention relates to techniques for performing authentication using SIP (Session Initiation Protocol) messages. More particularly, the present invention relates to techniques for performing UMTS (Universal Mobile Telecommunications System) authentication using SIP messages.

BACKGROUND ART

The SIP has been selected as the protocol over the UNI (User to Network Interface), that is, the interface between the mobile subscriber and the CSCF (Call State Control Function), for R00 (release 2000) and the current UMTS AKA (Authentication and Key Agreement) is one proposal for the authentication mechanism for the R00 UMTS.

The SIP has been defined in the IETF (Internet Engineering Task Force) draft standard RFC2543 (Request For Comments), issued March 1999 and the UMTS AKA has been defined in the 3GPP (3d Generation Partnership Project) specification TS 33.102, version 3.5.0, Release 1999, issued July 2000. The contents of this draft standard in its entirety and the contents of this specification in its entirety are both incorporated by reference herein.

As stated in the draft standard:

> The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol for creating, modifying and terminating sessions with one or more participants. The sessions include Internet

multimedia conferences, Internet telephone calls and multimedia distribution. Members in a session can communicate via multicast or via a mesh of unicast relations, or a combination of these.

SIP invitations used to create sessions carry session descriptions which allow participants to agree on a set of compatible media types. SIP supports user mobility by proxying and redirecting requests to the user's current location. Users can register that current location. SIP is not tied to any particular conference control protocol. SIP is not designed to be independent of the lower-layer transport protocol and can be extended with additional capabilities.

However, the use of the UMTS AKA procedure to perform authentication through SIP messages has not been disclosed in the draft standard.

Furthermore, in the IP Multimedia (IM) subsystem, which supports mobile IP telephony, a subscriber authentication mechanism must be standardized. Such an authentication mechanism has not yet been standardized. However, the UMTS AKA procedure will most likely be the chosen authentication mechanism. Therefore, a technique to perform UMTS AKA using the SIP protocol must be defined.

DISCLOSURE OF THE INVENTION

An object of the present invention, therefore, is to provide techniques for performing authentication using the UMTS AKA procedure and carrying the corresponding UMTS parameters through SIP messages. The authentication may be performed either by creating a new UMTS AKA authentication mode with the appropriate fields contained within an SIP message or alternatively, the authentication may be performed by reusing and adapting an existing authentication mode (e.g.-the digest mode or the PGP mode) of an SIP message.

Another object of the present invention, in the case of an IM subsystem, is to use SIP messages, which have been selected to be used as the call control protocol between the UE (User Equipment) and the CSCF, to carry the authentication parameters.

Still another object of the present invention is to reuse the UMTS AKA mechanism as a possible solution for the authentication procedure in the IM subsystem.

A further object of the present invention is to define which SIP messages and header fields are to be used to carry the UMTS authentication parameters in order to use the UMTS AKA mechanism for subscriber authentication in the IM subsystem and how to include the UMTS authentication parameters in the SIP header fields.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and a better understanding of the present invention will become apparent from the following detailed description of example embodiments and the claims when read in connection with the accompanying drawings, all forming a part of the disclosure of this invention. While the foregoing and following written and illustrated disclosure focuses on disclosing example embodiments of the invention, it should be clearly understood that the same is by way of illustration and example only and the invention is not limited thereto. The spirit and scope of the present invention are limited only by the terms of the appended claims.

The following represents brief descriptions of the drawings, wherein:

Figure 1 illustrates an example of data flow between an SIP UA (User Agent) and a CSCF.

Figure 2 illustrates an example of data flow between an SIP UA and a CSCF.

BEST MODE FOR CARRYING OUT THE INVENTION

Before beginning a detailed description of the subject invention, mention of the following is in order. When appropriate, like reference numerals and characters may be used to designate identical, corresponding, or similar components in differing drawing figures. Furthermore, in the detailed description to follow, example sizes/models/values/ranges may be given, although the present invention is not limited

thereto. In addition, elements may not be shown within the drawing figures for simplicity of illustration and discussion and so as not to obscure the invention.

Figure 1 illustrates an example of data flow between an SIP UA and a CSCF . However, a Proxy server may be substituted for the CSCF. According to the security policies, when a UMTS AKA needs to be performed, (e.g.-at a call setup or at registration), UA in the UE sends a REGISTER or INVITE request to the CSCF or Proxy. The CSCF or proxy can accept the registration with the 200 OK message or ask for an authorization with the 401 Unauthorized response.

According to the aforecited 3GPP specification, in order to execute a UMTS AKA procedure, to parameters must be sent to the user to authenticate it, namely, the RAND and the AUTN, and then the user will respond.

Therefore, 401 response includes the WWW-Authenticate response header field which contains the required authorization scheme and related parameters. In performing the UMTS AKA procedure in accordance with a present invention, the WWW-Authenticate header includes the RAND (RANDom challenge) and AUTN (Authentication Token).

After a 401 response, the UA may send a new REGISTER or INVITE request, which should contain the appropriate authorization information in the Authorization header field. In the case of the UMTS AKA procedure in accordance with the present invention, the Authorization header contains the RES or the AUTS or an error code (for example, an error message can be sent if the MAC (Message Authentication Code) is considered to be invalid).

Referring now to Figure 2, which illustrates proxy authentication after an INVITE request is presented, upon the UA forwarding an INVITE request to the CSCF, the CSCF may ask for an authentication with a 407 Proxy Authentication Required response. The 407 responds contains a Proxy-Authenticate response header field which contains the required authorization scheme and related parameters.

After receiving the 407 response, the UA sends an ACK (acknowledgment) response and may repeat the INVITE request, the repeated request containing the appropriate authentication information in the Proxy-Authorization header field.

In the case of the UMTS AKA procedure, the Proxy-Authenticate header contains the same information as the WWW-Authenticate header and the Proxy-Authorization header contains the same information as the Authorization header. Since this procedure can be used only when the UA sends a request, for example, when it initiates a call, the procedure cannot substitute for the authentication at registration.

Note that the REGISTER request, 200 OK message, and 401 Unauthorized response, as well as other parameters and elements contained in the above-noted discussion, are all clearly defined in the aforecited RFC2543 draft standard.

The aforecited draft standard defines three different techniques for SIP authentication, namely, an HTTP "basic" authentication mechanism and an HTTP "digest" authentication mechanism, and a PGP (Pretty Good Privacy) authentication mechanism. The HTTP authentication mechanisms are defined in the IETF draft standard RFC2617, issued June, 1999. The contents of this draft standard in its entirety are incorporated by reference herein.

While the three different techniques for SIP authentication are usable, for simplicity, the UMTS AKA technique may be advantageously used instead and the UMTS AKA elements may be substituted for the elements used for the three other SIP authentication techniques without needing a format revision in the SIP standard.

Accordingly, in accordance with the present invention, a 401 response includes a WWW-Authenticate response header field which contains the UMTS AKA authentication vectors, that is, the RAND (RANDom challenge) and the AUTN (authentication token).

After a 401 response, the UE a sends a new REGISTER/INVITE request which should contain the appropriate authentication information in the Authorization header field: the authentication response (RES), a synchronization failure parameter (AUTS), or an error code can be sent if the MAC (Message Authentication Code) is considered to be invalid.

Note that for a call setup, as will be discussed below, a 407 Proxy Authentication Required response may alternatively be used to carry the UMTS AKA parameters.

The present invention defines two ways to carry the UMTS AKA parameters in the SIP messages:

As noted above, the SIP standard defines three different techniques for authentication, namely, the HTTP basic authentication method, the HTTP digest authentication method and the PGP authentication mechanism.

Therefore, a new authentication mode, a UMTS AKA mode, could be defined with the necessary fields. Alternatively, the existing modes can be reused and adapted in order to perform the UMTS AKA procedure.

In order to be able to use the UMTS AKA procedure for authentication in IM subsystems, it is necessary to define how the UMTS AKA parameters are contained within the SIP messages. A new authentication method or mode may be introduced to include the UMTS AKA parameters in SIP messages. Noted below is a new authentication mode in accordance with the present invention. The new authentication mode contains headers which have been made as short as possible.

The WWW-Authenticate response header, in the case of a UMTS AKA procedure, must be able to carry both the RAND and AUTN. Accordingly, one example of a simple format which may be used is as follows:

WWW-Authenticate = "WWW-Authenticate" ":" "UMTS" RAND AUTN

RAND = "RAND" "=" RAND -value

AUTN = "AUTN" "=" AUTN -value

A hexadecimal format may be used for both the RAND and AUTN values.

The Authorization header, in the case of a UMTS AKA procedure, must be able to carry the RES value or the AUTS value. Accordingly, one example of a simple format which may be used is as follows:

Authorization = "Authorization" ":" "UMTS" RES | AUTS | AUTH-REJECT

RES = "RES" "=" RES-value

AUTS = "AUTS" "=" AUTS-value

AUTH-REJECT = "AUTH-REJECT" "=" error-code

A hexadecimal format may be used for both the RES and AUTS values.

The Proxy-Authenticate response header plays a role which is essentially the same as that of the WWW-Authenticate response header and therefore, one example of a similar format which may be used is as follows:

Proxy-Authenticate = "Proxy-Authenticate" ":" "UMTS" RAND AUTN

RAND = "RAND" "=" RAND-value

AUTN = "AUTN" "=" AUTN-value

Similarly, the Proxy-Authorization response header plays a role which is essentially the same as that of the Authorization response header and therefore, one example of a similar format which may be used is as follows:

Proxy-Authorization = "Proxy-Authorization" ":" "UMTS" RES | AUTS | AUTH-REJECT

RES = "RES" "=" RES-value

AUTS = "AUTS" "=" AUTS-value

AUTH-REJECT = " AUTH-REJECT" "=" error-code

Thus, in the case of an authentication mechanism in accordance with the present invention for use in an IM subsystem, UMTS AKA authentication may be used as a new authentication mode.

Since HTTP's basic and digest authentication mechanisms have been defined for use in the SIP draft standard, as noted below, the portions of the SIP message reserved for the digest mechanism may be alternatively used in accordance with a present invention to carry the UMTS AKA parameters:

For example, the "nonce" field formally used by the digest mechanism may be used to carry the UMTS AKA concatenated RAND and AUTN values in a hexadecimal format. Since the contents of the nonce field is implementation dependent, the length of the field must be large enough to carry the RAND and AUTN values. If this is not the case, the "opaque" field, defined in the draft standard, may be used to carry a portion of the UMTS AKA parameters.

The "response" field defined in the draft standard will be used for the UMTS AKA RES element. In case of a synchronization error, the AUTS will be included in the

"response" field. The first character of the "response" field can indicate that the response includes the RES, the AUTS, or an error code. The RES and the AUTS may be in a hexadecimal format.

In authenticating with the SIP message portion formally used for the digest mode, an "algorithm" field which formally specified which algorithm to use to compute the digest (MD5 may be used by default), may, in accordance with the present invention, be used to inform the receiver that this is a UMTS AKA procedure and in this way, the receiver will understand that the nonce field actually carries the RAND and AUTN.

As noted above, the PGP mechanism has been defined for authentication use in the SIP draft standard. As alternative, this mode may be used in accordance with the present invention to carry the UMTS AKA parameters. That is:

The "nonce" field may carry the RAND and AUTN values.

The "PGP = algorithm" may inform the receiver that it is a UMTS AKA procedure.

The result will be included in the "PGP-signature". Since this field may be more than 200 bits long, some of the first bits of this field may be used to specify the type of result, e.g.-RES, AUTS, or error code.

This concludes the description of the example embodiments. Although the present invention has been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this invention. More particularly, reasonable variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the foregoing disclosure, the drawings, and the appended claims without departing from the spirit of the invention. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

CLAIMS

What is claimed is:

1. A method of authenticating a user agent to a server using SIP (Session Initiation Protocol) messages, the method comprising:

forwarding an SIP request from the user agent to the server;

forwarding a request for authentication from the server to the user agent in response to the SIP request, the request for authentication including information that the authentication will be performed using a UMTS (Universal Mobile Telecommunications System) AKA (Authentication and Key Agreement) mechanism;

forwarding an authentication response from the user agent to the server in response to the request for authentication in accordance with the UMTS AKA mechanism; and

performing an invoked SIP procedure on the server in response to the SIP request if the authentication is deemed successful in view of the authentication response.

2. The method of claim 1, the SIP request comprising one of an SIP INVITE request or an SIP REGISTER request.

3. The method of claim 1, the request for authentication comprising one of an SIP 401 Unauthorized code or an SIP 407 Proxy Authentication Required code.

4. The method of claim 3, the request for authentication comprising UMTS AKA RAND (RANDom challenge) and AUTN (authentication token) vectors.

5. The method of claim 4, the RAND and AUTN factors being included in an SIP WWW-Authenticate or Proxy-Authenticate response header field.

6. The method of claim 1, the authentication response comprising one of a UMTS AKA RES (response) code or an AUTS (synchronization failure parameter) code or an error code.

7. The method of claim 6, the authentication response being included in an SIP Authorization or Proxy-Authorization header field.

8. The method of claim 1, the invoked procedure comprising an acknowledgement response comprising an SIP 200 code.

9. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of authenticating a user agent to a server using SIP messages, the method comprising:

forwarding an SIP request from the user agent to the server;

forwarding a request for authentication from the server to the user agent in response to the SIP request, the request for authentication including information that the authentication will be performed using a UMTS (Universal Mobile Telecommunications System) AKA (Authentication and Key Agreement) mechanism;

forwarding an authentication response from the user agent to the server in response to the request for authentication in accordance with the UMTS AKA mechanism; and

performing an invoked SIP procedure on the server in response to the SIP request if the authentication is deemed successful in view of the authentication response.

10. The storage device of claim 9, the SIP request comprising one of an SIP INVITE request or an SIP REGISTER request.

11. The storage device of claim 9, the request for authentication comprising one of an SIP 401 Unauthorized code or an SIP 407 Proxy Authentication Required code.

12. The storage device of claim 11, the request for authentication comprising UMTS AKA RAND (RANDom challenge) and AUTN (authentication token) vectors.

13. The storage device of claim 12, the RAND and AUTN factors being included in an SIP WWW-Authenticate or Proxy-Authenticate response header field.

14. The storage device of claim 9, the authentication response comprising one of a UMTS AKA RES (response) code or an AUTS (synchronization failure parameter) code or an error code.

15. The storage device of claim 14, the authentication response being included in an SIP Authorization or Proxy-Authorization header field.

16. The storage device of claim 9, the invoked procedure comprising an acknowledgement response comprising an SIP 200 code.

FIG. 1

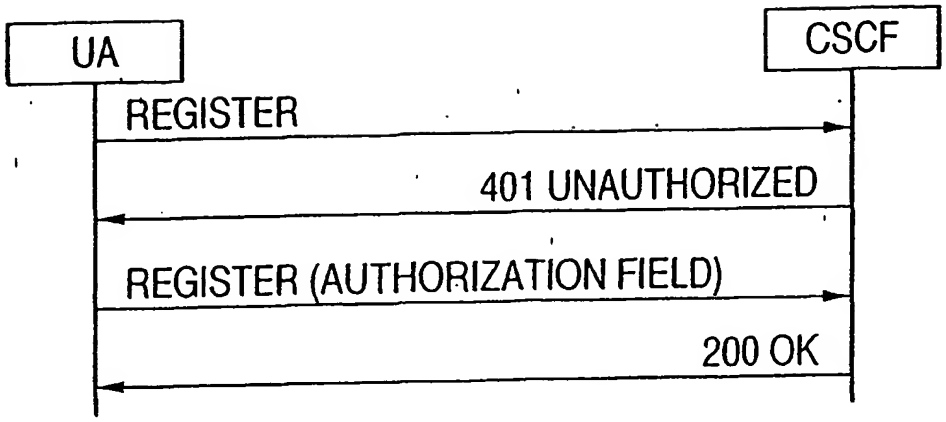
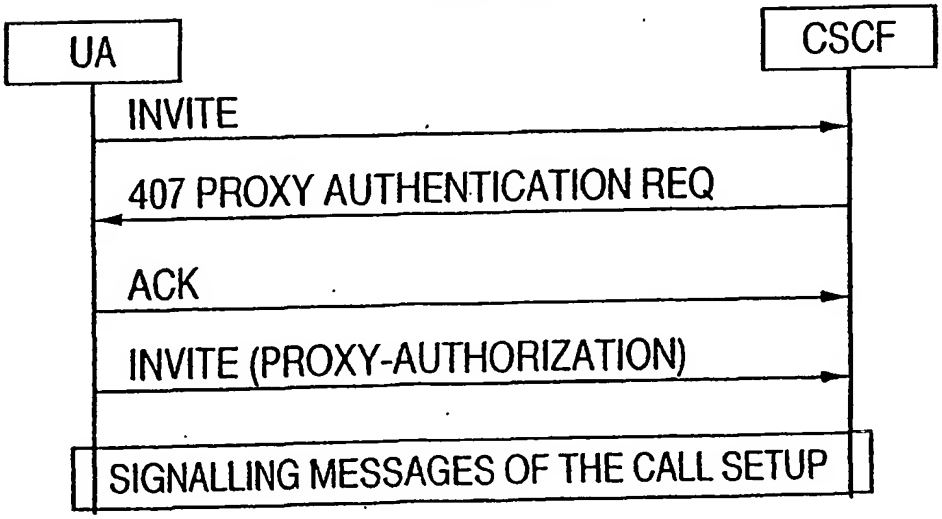

UA
CSCF
REGISTER
401 UNAUTHORIZED
REGISTER (AUTHORIZATION FIELD)
200 OK

FIG. 2


UA
CSCF
INVITE
407 PROXY AUTHENTICATION REQ
ACK
INVITE (PROXY-AUTHORIZATION)
SIGNALLING MESSAGES OF THE CALL SETUP